Space Weather Technical Forecast

Issued on Monday, 02 May 2022 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Brief lull in risk of R1/R2 radio blackouts, however activity on both eastern and western limbs.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low over the past 24 hours, with occasional C-class flares. The largest flare of the period was a long-period C3.1 at 01/1128UTC. This flare emanated from the vicinity of returning region Ex-2992 over the southeastern limb, and perhaps provides a hint of an upturn in activity into the coming week. This is after the current brief lull, with the passing of many of the very active northwestern limb groups, namely Ex-2993, Ex-2994 and shortly the plage containing Ex-2996. There are currently two sunspots on the visible disc, which are both unipolar and simple Hsx/alpha groups, which are stable and unremarkable. A third small group, AR2997 faded to plage in the northwestern quadrant in the same period. Numerous CMEs were seen from both limbs of the disc during the period, mainly in the vicinity of the aforementioned northwestern groups, although none of these CMEs are thought to be Earth-directed. No Earth-directed CMEs were observed in coronagraph imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, remains characteristic of a negative polarity fast wind (negative phi, towards the sun), which is thought to be associated with CH78/- in the southwest quadrant. There are signs of this feature beginning to wane, with wind speeds at around 530km/s (elevated) at the start of the period, with a steady decline, down to 440km/s (slightly elevated) at present. The solar wind density was steady throughout, remaining in single figures ppcc, while the IMF showed a peak of 7nT at 01/0836UTC, with the north-south component was weak, with a peak of +/-5nT.

The net result of the above solar wind measures was Quiet to Unsettled geomagnetic activity, provisionally peaking at Kp 3 in the 00-03UTC interval.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) was only very slightly elevated above background, having declined steadily in the wake of the M1.1 flare on 29 April.

The high energy electron flux (greater than 2MeV) showed an increase on the previous day, reaching High flux and 1550pfu at 01/1500UTC. Resulting 24-hour integrated electron fluence has been below the Active threshold (1e8 integrated pfu), but with a rising trend, recording 4.7e7 integrated pfu at 02/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Activity should undergo a decline in the immediate term, with the passing of successive active northwestern limb groups, however there is a chance of some recovery as a further active region likely rotates onto the southeast quadrant in the coming days.

Solar Wind / Geomagnetic Activity: The current fast wind is the only such feature in the

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period, and should wane through day 1 (Monday 02 May). No Coronal Mass Ejections (CMEs) feature in the forecast.

Occasional Unsettled intervals should decrease in frequency leaving Quiet geomagnetic activity from midweek.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) carries a slightly raised chance of passing S1 at first, due to the presence of numerous active regions narrowly over the western limb, however this risk should reduce to background in the coming days.

The high energy electron flux (greater than 2MeV) is likely to spend a greater amount of time within High flux during the first part of this forecast period, in response to CH78's high speed stream, before a steady decline, due to the absence of any further significant geomagnetic activity. The chances of 24-hour integrated electron fluence exceeding Active (1e8 integrated pfu) should therefore soon peak, but most likely remain below threshold.

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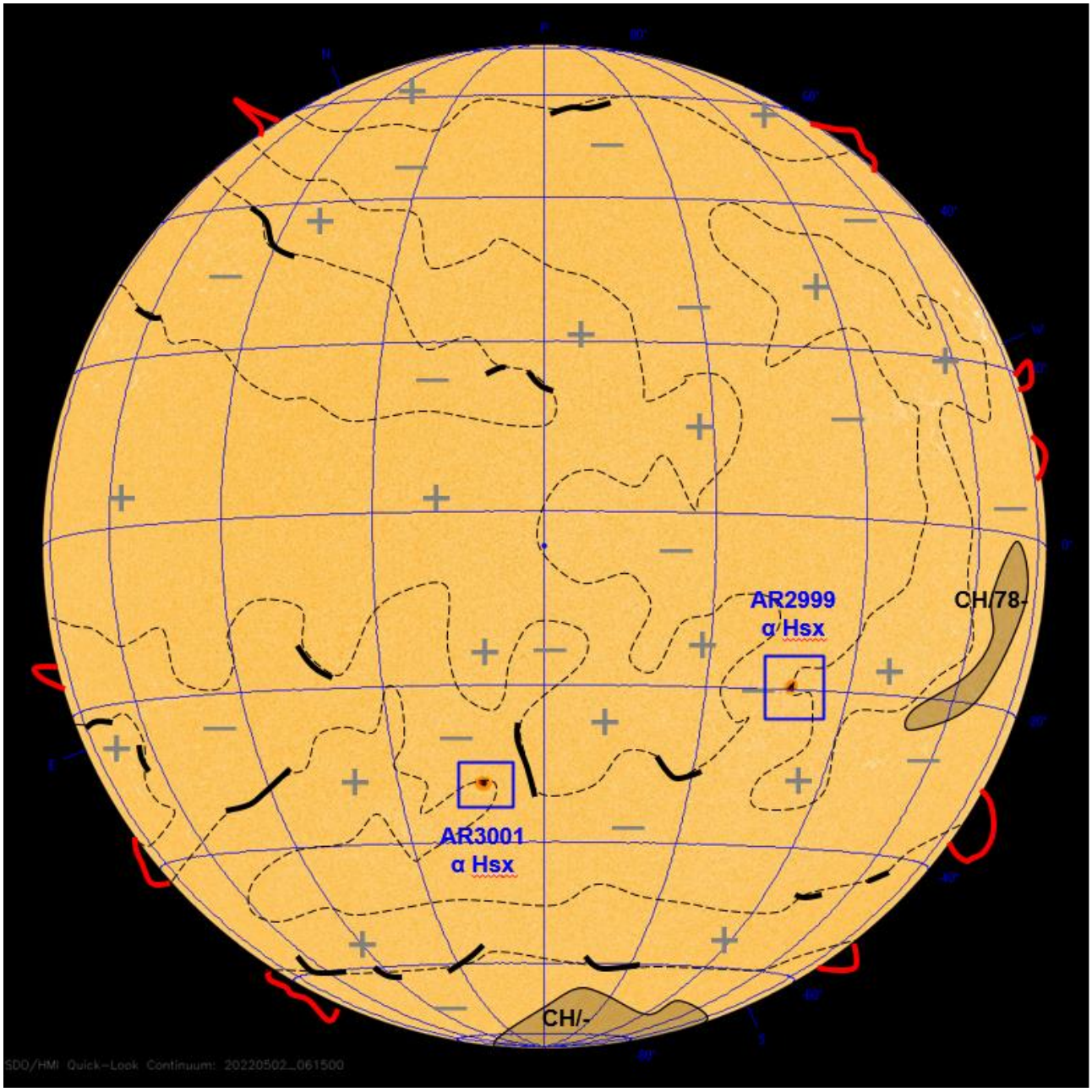
Figure 1. Solar Analysis Valid 02/0615UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs feature in this forecast period. A partial halo shock that was previously forecast to potentially affect Earth during 01 May is now considered to have passed, leaving no further transients in the forecast.

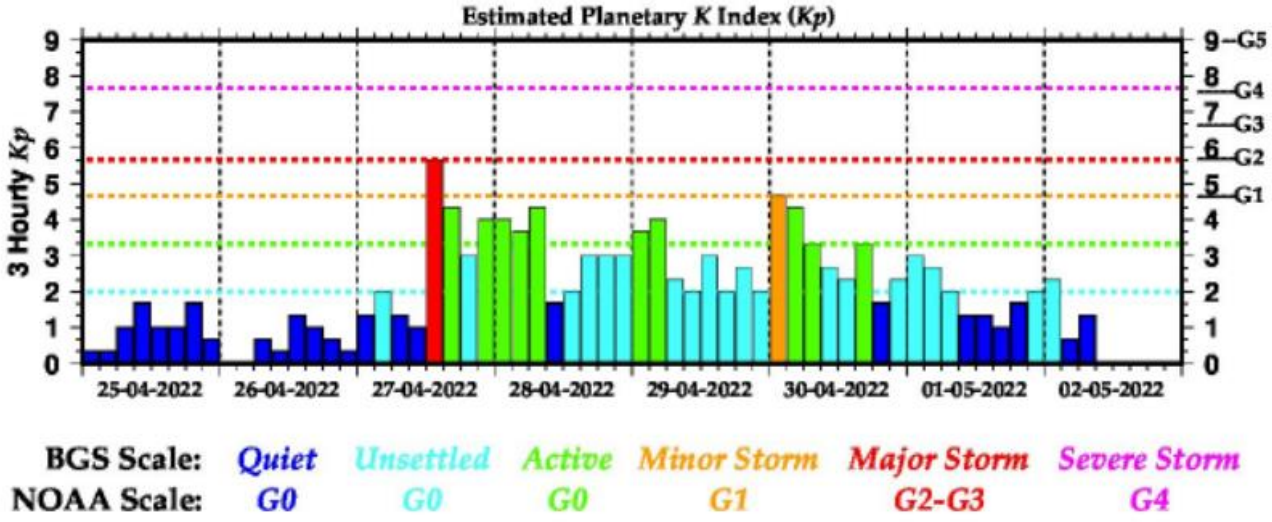
The current fast wind enhancement from coronal hole 78 is the only such feature due in the four days, and has long peaked. A gradual waning of this fast wind should continue through day one, Monday 02 May, with fewer Unsettled intervals with time, leaving Quiet conditions from midweek.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: BGS Planetary K-index (Kp) shows geomagnetic activity becoming mostly Quiet, after recent activity.



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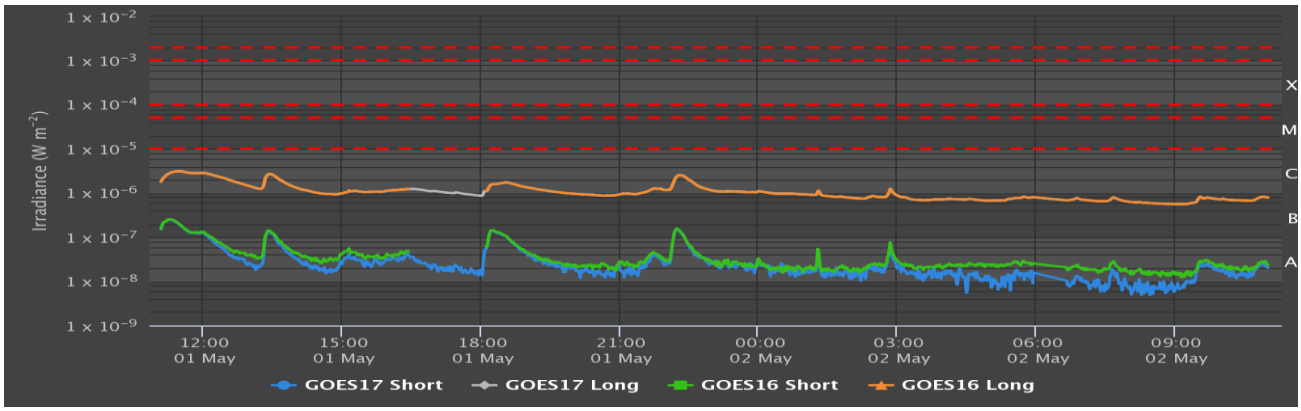
Radio Blackouts - X-Ray Flares:
Earth is expected to see a brief grace period in the risk of radio blackouts on day one, Monday 02 May, as recent active sunspot regions depart from the northwestern limb, while bright flux looming over the southeastern horizon has yet to arrive.

Any M-class activity is perhaps most likely from the plage containing Ex-2996 at first, being the furthest east of the northwestern limb regions, with the risk later transferring to the arriving Ex-2992 in the southeast, although the degree of any upturn into the new working week remains to be seen once this region shows for analysis. All considered, there is a continued Slight Chance of M-class activity, with a token increase signalled from day two, Tuesday 03 May that may be revised once Ex-2992 fully reveals itself.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16 X-Ray Flares – shows occasional C-class flares last 24 hours.



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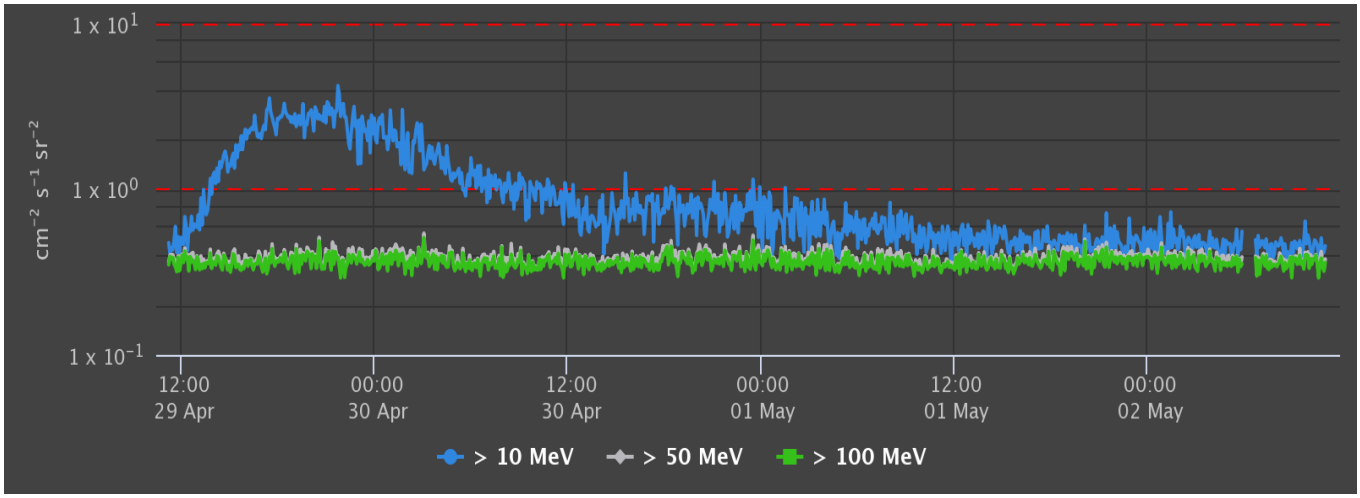
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background levels, and is most likely to remain so through the next four days.

The presence of Ex-2994, Ex-2993 and the plage from Ex-2996 all lying near the better-connecting western limb at present all serve to slightly increase the risk above background at first, falling to become negligible by day 4 (Thursday 05 May). Note that none of these regions proved capable of delivering solar radiation storms while on the Earth-facing side, the closest being a 2pfu 10MeV enhancement peaking on 29 April in the wake of Ex-2996's M1 flare of a few hours prior.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	2	2	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 4: GOES-16 Proton Flux – shows a gradual decline towards background levels after the recent M1.1 flare on the 29 April.



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High Energy Electrons Event (≥ 2MeV):
The current waning of geomagnetic activity from the current fast wind of CH78 should allow electron flux at GEO to remain close to or above the high flux active threshold on days 1 and 2 (02 May and 03 May), before gradually returning to background levels by the end of the forecast period.

With no transients expected to influence this forecast, confidence in REFM should improve, and the current forecast for an initially rising trace then plateauing at sub-Active levels is therefore accepted.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	60	50	40	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 5: GOES-16 Electron Flux – which has been at High levels over the last 24 hours and is likely to reach above the High threshold during day 1 (Monday 02 May).

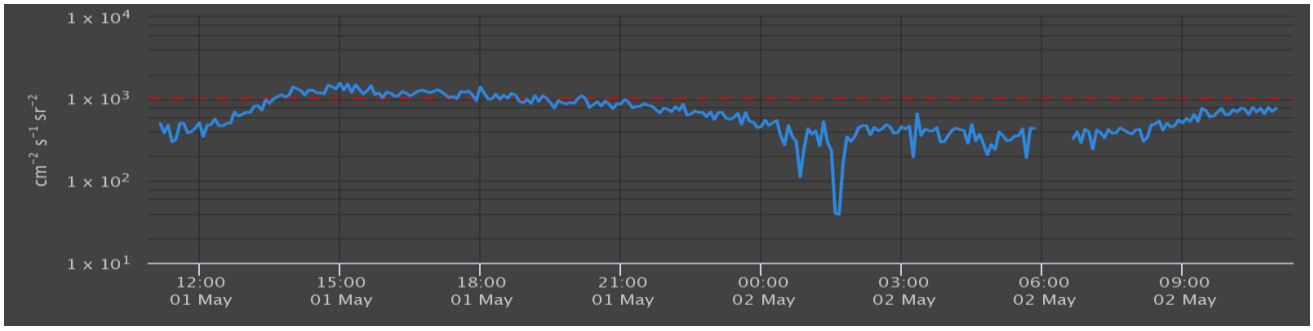
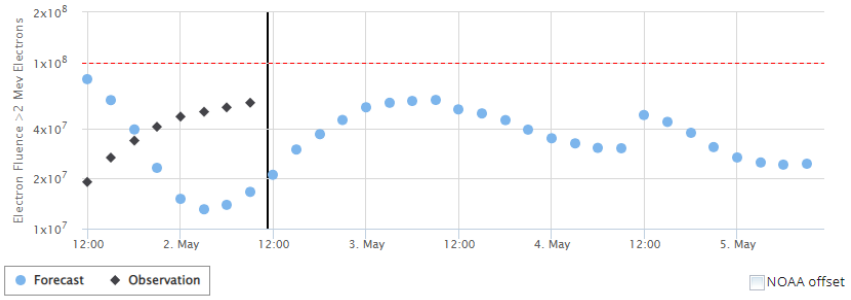


Figure 6: REFM electron fluence – shows a slight rising trend compared to the forecast, but is expected to remain below the Active threshold throughout.



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